**Genetics Problem Set**

*Answer the following questions PROPERLY on a separate sheet of paper.*

1. What kind of gametes can the following individuals make?

Ww WwXx WwXxyyZz

**Monohybrid Crosses**

1. In summer squash, white fruit colour (W) is dominant over yellow fruit colour (w). If a squash plant homozygous for white is crossed with one homozygous for yellow, what will be the appearance of the F1 generation and in what ratio?
2. Cross two of the F1 generation from above, what are the phenotypes and phenotypic frequencies of the F2 generation?
3. A white fruited squash plant when crossed with a yellow-fruited one produces offspring about half of which are white and half of which are yellow. What are the genotypes of the parents?
4. A cross between a white-fruited and a yellow-fruited squash plant produces all white plants. If two of these F1 plants cross, what will be the appearance of their offspring?
5. A homozygous brown mink was crossed with a silver-blue mink. Brown (B) is dominant to silver-blue. There were nine offspring.
   1. What colour were they and what was the phenotypic frequency?
   2. Two of these offspring were mated. What would be the ratio of brown to silver-blue offspring?
   3. What fraction of the offspring will be
      1. Homozygous brown?
      2. Heterozygous?
      3. Homozygous silver-blue?
6. In humans, normal skin pigmentation is due to a dominant gene. Albinism is due to its recessive allele. A normal man marries an albino woman. Their first child is an albino.
   1. What are the genotypes of these three people?
   2. If they have more children, what will their skin pigmentation probably be, and in what ratio?
7. Two normally-pigmented parents produce an albino child. If they produce another child, what are the chances of it being albino?
8. Consider the ability to bend one’s thumb backwards in humans as dominant to being unable to bend one’s thumb backwards. Show the expected children of a marriage between a woman who cannot bend her thumb backwards and a man who can bend his thumb backwards, but his mother could not.
9. Suppose that you are breeding cats who are afflicted with an inherited trait that causes blindness. In order to eliminate this undesirable trait, would you rather that this trait be inherited by a dominant or recessive allele? Justify your answer.
10. True or false. Dominant alleles are more frequent than recessive alleles.
11. Griselda has blue eyes but both her parents are brown eyed. She marries Rumplestiltskin who is a brown eyed man whose mother was blue eyed.
    1. What are the genotypes of Griselda’s parents?
    2. What is Rumplestiltskin’s genotype?
12. What is a test cross? When would you do a test cross. How do you do a test cross?
13. John has a golden coloured hamster. He knows that the golden colour is dominant to brown colour for hamsters. Show how he will use a test-cross to determine the genotype of his hamster.
14. \* The cystic fibrosis gene (f) is recessive to the normal gene (F) for lung function. Cystic Fibrosis (CF) is a disease which leads to a buildup of mucous in the lungs and leads to premature death (<40 years) . Only those who are recessive (ff) will have cystic fibrosis. Those who ‘carry’ the cystic fibrosis gene but do not have the disease are heterozygous and are called ‘Carriers’. Jocelyn does not have cystic fibrosis, but she just had a baby with cystic fibrosis. What is her genotype? Is she a carrier? What is her husbands genotype? Is he a carrier?
15. \* Tay-Sachs is a fatal neurological disorder that leads to the deterioration of muscle and physical abilities by a very young age. The Tay-Sachs gene (g) is recessive to the normal gene (G). Some ethnic groups (such as Eastern European Jews) are more likely to have this gene. In fact, if two Jews of Eastern European descent are going to get married, they will often get tested ahead of time to see if they ‘carry’ the recessive gene for Tay-Sachs. Assuming there is a test where you can see a persons genotype, if one parent does NOT carry the Tay Sachs allele, do you still need to test the other one? Why/why not?

**Dihybrid Crosses**

1. What is the difference between a dihybrid cross and a monohybrid cross? Can you use monohybrid crosses in place of a dihybrid cross? Explain.
2. What is Mendel’s Law of Independent Assortment? Explain it in simple terms that your 12-year-old cousin can understand.
3. A heterozygous brown-eyed blonde-haired man, marries a blue-eyed, homozygous red-haired woman. Assume brown eyes are dominant over blue eyes and red hair is dominant over blonde hair. What is the phenotypic ratio of their F1 generation?
4. In cattle, long horns (L) are dominant over short horns (l) , and black coat (B) is dominant over white coat (b). Determine the phenotypes and frequencies of the F1 generation produced by across between a short-horned heterozygous black bull and a heterozygous long-horned white coat cow.
5. Assume curly hair is dominant to straight hair. Albinism is a condition in which cells which normally produce pigment do not do so. The allele for albinism is recessive to the normal skin allele. A woman with curly hair and albinism and a man with straight hair and normal skin pigment have a child that has straight hair and is an albino (he has albinism). What are the genotypes of the parents?
6. In rabbits, black fur is dominant over brown fur. Normal length fur is determined by a dominant gene called Rex (R). The recessive gene produces a short coat. Show a cross between a homozygous black rabbit with homozygous normal length fur, and a brown, short-coat rabbit. Cross the rabbits to create an F2 generation. What are the genotypic and phenotypic ratios of the offspring?
7. Black coat colour in cocker spaniels is governed by a dominant allele, and red coat colour by a recessive allele. Solid pattern is determined by the dominant allele S. While white spotted pattern is determined by the recessive gene (s). A solid black male is mated to a solid red female. They produce the following litter of 6 puppies: 2 solid black, 2 solid red, 1 spotted black, 1 spotted red. Determine the most probably genotype of the parents
8. A self cross is when you mate a plant with itself, or with an identical sibling. . This can be done in plants by pollenating a plant’s female sex organs using the plants own pollen. If Soo-Yung self crossed a heterozygous tall, round seed plant (TtRr), what would be the genotypic frequencies of the offspring?
9. Brown eyes are dominant to blue eyes, and a widow’s peak (W) hairline is dominant to a straight (w) hairline. We want to find out the offspring and phenotypic/genotypic ratios of the marriage between a man who has blue eyes and a widows peak, and a woman who has Brown eyes and straight hair. What other information do we need before we can solve the problem?
10. Assume that for question 9, the man’s mother had a straight hairline, and the woman’s father had blue eyes. Now can we solve the question? If so, what are the genotypic and phenotypic ratios of the offspring.